On the Application of a Nicol's Prism to Sextant Observations.

By Thomas Mackenzie.

(*Communicated by Capt. H. Toynbee.*)

I beg to submit to the consideration of the Royal Astronomical Society the application of the Nicol's prism to sextant observations made at sea, for up to the present moment I am unaware of a polariser having been employed with the sextant. My application of it is as follows. A Nicol's prism is inserted in the inverting telescope on the object-glass side of the diaphragm and close against it, and so placed that when the telescope is screwed home in its collar the polarising plane will be parallel to the plane of the sextant, and consequently perpendicular to the plane of the horizon when making observations. Now at sea observations for time are usually taken when the Sun has an altitude of between 30° and 40° in low latitudes, at which time there is a considerable glare on the horizon, rendering it very indistinct even when the coloured shades are used. In high latitudes, such as that of England, except in midsummer, there is always more or less horizon glare even at the Meridian altitude, so that the advantages of such an instrument would be more striking. The glare of light from the horizon is totally refracted out of the prism, and only the extraordinary ray transmitted to the eye, rendering the horizon comparatively dark and clearly defined, and free from the displacement which coloured shades wanting in parallelism of their faces always give.

I have now employed the instrument at sea during a voyage to the West Indies and South America, and it has fulfilled all I expected of it.

R.M.S. "Moselle," Southampton:
1885, *August* 13.

Ephemeris for Physical Observations of Mars, 1886.

By A. Marth.

Greenwich Noon.	Angle of Position of ♂'s axis.	Areographical Longit. of Centre of Disc.	Areographical Latit. of Centre of Disc.	Diameter.	q	Q	E	Log. Light ratio.
1885.	°	°	°	″	″	°	°	
Dec. 24	20·85	94·49	+23·52	8·30	0·76	292·58	35·32	9·2205
26	21·19	75·65	23·50	8·44	·77	292·53	35·05	·2351
28	21·50	56·83	23·47	8·58	·77	292·47	34·75	·2499
30	21·79	38·05	23·43	8·73	·76	292·40	34·42	·2650
1886.								
Jan. 1	22·07	19·31	+23·39	8·88	0·76	292·33	34·06	9·2804
3	22·33	0·60	23·35	9·04	·76	292·24	33·67	·2960
5	22·57	341·92	23·30	9·20	·75	292·14	33·24	·3118

Greenwich Noon.	Angle of Position of ♂'s axis.	Areographical Longit. of Centre of Disc.	Areographical Latit. of Centre of Disc.	Diameter.	q	Q	E	Log. Light ratio.
1886.	°	°	°	″	″	°	°	
Jan. 7	22·79	323·28	23·25	9·36	·75	292·03	32·78	9·3278
9	22·98	304·69	23·20	9·53	·74	291·92	32·29	·3441
11	23·16	286·14	23·15	9·70	·73	291·79	31·76	·3605
13	23·32	267·63	23·10	9·88	·71	291·64	31·18	·3770
15	23·46	249·17	23·05	10·06	·70	291·48	30·57	·3937
17	23·57	230·75	22·99	10·24	·68	291·31	29·92	·4105
19	23·66	212·37	22·93	10·43	·66	291·13	29·22	·4274
21	23·72	194·05	22·87	10 61	·64	290·92	28·48	·4443
23	23·77	175·77	22·81	10·81	·62	290·69	27·70	·4612
25	23·79	157·55	22·76	11·00	·59	290·44	26·86	·4781
27	23·78	139·38	22·70	11·20	·57	290·17	25·98	·4949
29	23·75	121·27	22·65	11·39	·54	289·87	25·05	·5115
31	23·69	103·21	22·60	11·59	·50	289·53	24·07	·5280
Feb. 2	23·61	85·20	+22·55	11·79	0·47	289·16	23·03	9·5442
4	23·50	67·25	22·50	11·99	·43	288·74	21·95	·5601
6	23·36	49·36	22·46	12·18	·40	288·27	20·81	·5756
8	23·20	31·52	22·41	12·37	·36	287·73	19·62	·5907
10	23·01	13·74	22·37	12·55	·32	287·11	18·38	·6052
12	22·79	356·01	22·33	12·73	·28	286·39	17·09	·6191
14	22·55	338·33	22·29	12·90	·24	285·54	15·76	·6322
16	22·28	320·70	22·25	13·06	·20	284·52	14·39	·6446
18	21·98	303·12	22·21	13·22	·17	283·29	12·97	·6562
20	21·66	285·58	22·17	13·36	·13	281·72	11·52	·6668
22	21·32	268·08	22·14	13·49	·10	279·64	10·03	·6764
24	20 95	250·61	22·10	13·61	·07	277·0	8·54	·6850
26	20·57	233·18	22·07	13·71	·05	273·1	7·03	·6924
28	20·17	215·77	22·04	13·80	·03	268·1	5·54	·6986
Mar. 2	19·75	198·39	+22·00	13·87	0·02	256·9	4·14	9·7036
4	19·33	181·02	21·97	13·92	·01	237·5	2·97	·7073
6	18·89	163·65	21·94	13·95	·01	203·4	2·44	·7096
8	18·45	146·28	21·91	13·96	·01	168·7	2·93	·7106
10	18·01	128·91	21·89	13·95	·02	148·7	4·09	·7103
12	17·57	111·53	21·86	13·93	·03	138·2	5·50	·7087
14	17·13	94·13	21·84	13·89	·05	132·0	7·00	·7058
16	16·71	76·71	21·82	13·83	·08	128·0	8·54	·7016
18	16·29	59·25	21·80	13·75	·11	125·22	10·07	·6963
20	15·89	41·76	21·79	13·66	·14	123·13	11·59	·6948
22	15·51	24·24	21·78	13·56	·18	121·52	13·08	·6823

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1886	°	°	°	″	″	6	°	
Mar. 24	15·15	6·67	21·78	13·44	·22	120·22	14·54	9·6738
26	14·81	349·05	21·78	13·31	·26	119·16	15·97	·6643
28	14·50	331·39	21·79	13·17	·30	118·27	17·36	·6540
30	14·21	313·67	21·81	13·02	·34	117·51	18·71	·6429
Apr. 1	13·95	295·90	+21·83	12·86	0·39	116·85	20·01	9·6311
3	13·71	278·08	21·86	12·69	·43	116·28	21·26	·6187
5	13·51	260·20	21·90	12·52	·48	115·78	22·46	·6058
7	13·34	242·26	21·95	12·35	·52	115·35	23·61	·5924
9	13·20	224·26	22·00	12·17	·56	114·97	24·71	·5786
11	13·09	206·21	22·06	11·99	·60	114·63	25·76	·5645
13	13·01	187·10	22·13	11·81	·63	114·33	26·76	·5501
15	12·96	169·94	22·21	11·62	·67	114·07	27·71	·5356
17	12·95	151·72	22·29	11·44	·70	113·84	28·61	·5209
19	12·96	133·45	22·38	11·26	·73	113·64	29·47	·5061
21	13·00	115·13	22·48	11·08	·76	113·47	30·28	·4913
23	13·07	96·75	22·58	10·91	·78	113·32	31·04	·4764
25	13·17	78·33	22·69	10·73	·80	113·19	31·76	·4616
27	13·29	59·86	22·80	10·56	·82	113·08	32·44	·4469
29	13·44	41·34	22·92	10·39	·84	112·99	33·08	·4322
May 1	13·61	22·78	+23·04	10·22	0·86	112·91	33·69	9·4176
3	13·80	4·18	23·16	10·06	·87	112·85	34·25	·4032
5	14·02	345·53	23·29	9·90	·88	112·80	34·78	·3889
7	14·27	326·84	23·42	9·74	·89	112·77	35·27	·3748
9	14·53	308·11	23·55	9·59	·90	112·75	35·73	·3610
11	14·81	289·34	23·68	9·45	·91	112·74	36·15	·3473
13	15·11	270·54	23·81	9·30	·91	112·73	36·55	·3338
15	15·43	251·70	23·94	9 16	·92	112·74	36·91	·3206
17	15·77	232·82	24·08	9·02	·92	112·75	37·25	·3076
19	16·12	213·91	24·21	8·89	·92	112·77	37·56	·2948
21	16·49	194·98	24·34	8·76	·92	112·79	37·85	·2823
23	16·87	176·01	24·47	8·63	·92	112·81	38·11	·2700
25	17·27	157·01	24·59	8·51	·92	112·84	38·35	·2580
27	17·68	137·98	24·72	8·39	·92	112·88	38·57	·2462
29	18·10	118·93	24·84	8·27	·91	112·91	38·77	·2347
31	18·53	99·85	24·95	8·16	·91	112·95	38·94	·2234
June 2	18·97	80·74	+25·06	8·05	0 90	112·99	39·10	9·2123
4	19·42	61·61	25·17	7·95	·90	113·03	39·24	·2015
6	19·88	42·46	25·27	7·84	·89	113·07	39·36	·1910

Greenwich Noon.	Angle of Position of ♂'s axis.	Areographical Longit. of centre of Disc.	Areographical Latit. of centre of Disc.	Diameter.	q	Q	E	Log. Light ratio.
1886.	°	°	°	″	″	°	°	
June 8	20·35	23·28	25·36	7·74	·88	113·11	39·46	9·1807
10	20·83	4·08	25·45	7·64	·87	113·15	39·55	·1706
12	21·31	344·85	25·53	7·55	·87	113·19	39·62	·1608
14	21·80	325·61	25·60	7·46	·86	113·23	39·67	·1512
16	22·29	306·35	25·67	7·37	·85	113·26	39·71	·1419
18	22·79	287·07	25·73	7·28	·84	113·29	39·74	·1328
20	23·29	267·77	25·78	7·20	·83	113·32	39·76	·1239
22	23·79	248·46	25·82	7·12	·82	113·34	39·77	·1153
24	24·30	229·13	25·85	7·04	·81	113·36	39·76	·1068
26	24·81	209·78	25·87	6·96	·80	113·38	39·74	·0986
28	25·32	190·42	25·88	6·89	·79	113·39	39·71	·0906
30	25·82	171·04	+25·89	6·81	0·78	113·39	39·67	9·0828

Q denotes the position-angle, and q the amount of the greatest defect of illumination; E the areocentric-angle between Earth and Sun. The last column gives the logarithm of the ratio of the apparent brightness of *Mars* to that at mean opposition, computed upon the supposition that the diminution of brightness due to the phase depends simply on the proportion of the unilluminated portion to the whole of the disc. The maximum value of the logarithm of this light-ratio during the last four oppositions has been

1877	Sept. 3	0·3696	1881	Dec. 20	9·8442
1879	Nov. 3	0·1021	1884	Jan. 30	9·7163

while that of the coming opposition is

1886 Mar. 6 9·7106

The data of the ephemeris are to be interpolated directly for the times for which they are required, the equation of light having already been taken into account. The difference of successive values of the longitude of the centre of the disc amounts to one rotation and some 340 degrees, so that, for instance, the difference from December 24 to 26 is 701°·16, which must be borne in mind in interpolating.

As the observations of *Mars* made during the last two oppositions do not seem to have contributed anything further towards a better determination of the position of the planet's equator, I have now made the slight change from the values of the node N and inclination J in reference to the plane of the Earth's equator of 1880·0

$$N = 47°{\cdot}945 \qquad J = 36°{\cdot}260,$$

which I had adopted in the ephemeris for 1879 (vide vol. xxxix. p. 473) to those determined by Schiaparelli from his own measurements of 1877 and 1879

$$N = 48^\circ{\cdot}130 \qquad J = 36^\circ{\cdot}382.$$

The Zero-Meridian has also been shifted in order that it may pass, as nearly as Schiaparelli's measurements will permit, through the point of the tongue of the forked bay of Dawes or through Schiaparelli's Fastigium Aryn. The correction applied is $+1^\circ{\cdot}32$ for the beginning of 1880.

I have, further, made the slight change from the daily rate of rotation $350^\circ{\cdot}8922$, which I had used since 1864, to the rate $350^\circ{\cdot}89214$, which I have deduced from what appear to me by far the best old observations available for the purpose—namely, those made by Maraldi in 1704 and the corresponding ones of Schiaparelli made in 1879, as already mentioned in vol. xliii. p. 493. The daily rate $350^\circ{\cdot}89214$ is the tropical one in reference to the equator; the sidereal rate is $0^\circ{\cdot}0000384$ greater, and the corresponding period of the sidereal rotation of *Mars* is $24^h\ 37^m\ 22^s{\cdot}63$, only $0^s{\cdot}01$ greater than Kaiser's value of 1864. In another communication I shall give, for the times assigned to the older sketches, the areographical longitudes and latitudes of the centre of the disc according to the system adopted in the present ephemeris.

It is desirable that the question should be settled how far the variations in the aspect of the dark markings on *Mars* are due to the relative position of the Sun and the Earth, and especially what changes take place in the aspect of a marking, when, in the course of rotation, it reaches or leaves the vicinity of the point where Sun and Earth have the same areocentric zenith distances, but opposite azimuths. Though this point may be found from the data of the ephemeris, as it is in position-angle $Q+180^\circ$ and at the areocentric angular distance $\frac{1}{2}E$ from the apparent centre of the disc, or geocentrically at the distance $\sin\frac{1}{2}E$ of the semi-diameter, observers may perhaps be more readily induced to watch their opportunities, if they can easily get the areographical longitude ω' and latitude β' of the point. I give, therefore, at intervals of eight days, the difference $\omega'-\omega_0$ of the longitude of the point in question from that of the central meridian ω_0, and also the latitude β'. In the last column I have added the areocentric longitude of the Sun reckoned in the plane of the orbit from the ascending node of the orbit on the planet's equator, or analogous to the reckoning of the Sun's geocentric longitude in the ecliptic, so that the actual season on *Mars* corresponds to the terrestrial season when the Sun's geocentric longitude is $=\odot'$.

	$\omega'-\omega_\odot$	β'	$\odot'$		$\omega'-\omega_\odot$	β'	$\odot'$
1885.	°	°	°	1886.	°	°	°
Dec. 24	−19·1	+21·8	47·6	Mar. 30	+ 9·9	+23·7	89·7
1886.							
Jan. 1	−18·4	22·2	51·1	April 7	12·6	23·9	93·3
9	−17·5	22·5	54·6	15	14·9	24·2	96·8
17	−16·2	22·7	58·2	23	16·8	24·5	100·4
25	−14·6	22·9	61·7	May 1	18·3	24·7	104·1
Feb. 2	−12·5	23·0	65·1	9	19·5	24·9	107·7
10	− 9·9	23·0	68·6	17	20·5	25·0	111·4
18	− 7·0	23·0	72·1	25	21·1	25·0	115·1
26	− 3·6	23·1	75·6	June 2	21·6	24·9	118·9
Mar. 6	− 0·1	23·2	79·1	10	21·8	24·6	122·7
14	+ 3·5	23·3	82·6	18	21·9	24·3	126·5
22	+ 6·8	+23·4	86·2	26	+21·8	+23·8	130·4